IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF GEORGIA
ATLANTA DIVISION

DONNA CURLING, ET AL.,	
PLAINTIFFS,	CIVIL ACTION NO. 1:17-CV-2989-AT
V.	
BRAD RAFFENSPERGER, ET AL.,	
DEFENDANT.	

DECLARATION OF NATHAN D. WOODS, PHD IN SUPPORT
OF PLAINTIFFS' MOTION FOR A PRELIMINARY INJUNCTION

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I. BACKGROUND AND QUALIFICATIONS

1.   I am a Partner with Edgeworth Economics, a firm specializing in economic and statistics research, where I have worked for four years. I worked previously with Welch Consulting for more than 13 years, most recently as Vice President and Director of the firm's Washington DC office. I have submitted expert reports and testified on damages issues, statistics, analysis of class certification topics, the use of data in wage and hour matters, sampling, and extrapolation, in administrative, state and federal courts. I also work extensively on a consulting basis to analyze data relating to hiring, promotions, terminations, compensation, lost earnings and other topics.

2.   I earned a PhD in Political Science from the Claremont Graduate University's School of Politics and Economics where my academic training and research were focused on answering empirical questions using statistical methods. I took many courses on or involving quantitative methods and sampling. I have taught several courses, including a graduate seminar in advanced quantitative methods and an upper level undergraduate seminar in public opinion. I have published numerous peer reviewed papers in academic journals, and I have written pieces for trade publications as well on topics related to statistics, class certification and sampling. I speak often at Continuing Legal Education conferences and in webinars on statistical topics relating to analysis of class action issues, sampling and representative data, and estimates of damages. My firm is providing my services and the services of my associates on a pro bono basis and my compensation is not contingent on my opinions or the outcome of the case. A

copy of my curriculum vitae, which includes a list of my publications and testimony, is attached as **Appendix A**.

II. ASSIGNMENT

3.   I have been asked by counsel for the Curling Plaintiffs to review and comment upon the Declaration of Michael Shamos, PhD., J.D., in Opposition to Plaintiffs' Motion for a Preliminary Injunction, ECF No. 472-1 (the "Shamos Declaration") with specific reference to his discussion of "parallel testing."[1] In preparing this declaration I, and staff working under my direction, reviewed the Shamos Declaration. A list of materials upon which I relied to develop my opinions is attached as **Appendix B**.[2]

III.   PARALLEL TESTING USING A SAMPLE OF ONE MACHINE IS INADEQUATE

4.   In his declaration, Dr. Shamos states that parallel testing is a means of auditing DRE machines to uncover whether malware is operating on DRE machines, and votes have been altered. In his discussion Dr. Shamos describes how parallel testing would occur:

> "In proper parallel testing, officials select a precinct at random and
> designate a machine to be voted on, but its votes will not be counted
> in the election. The officials then cast a predetermined set of ballots
> (generated at random based on the political demographic of the

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[1] Shamos Decl., at ¶¶ 97-101, 131-134.

[2] If additional information is provided to me in this litigation, I will analyze it, consider it as part of my opinions and supplement this report, as appropriate.

precinct) while the election is in progress. If malware is present that alters votes, the reported totals will not correspond to the predetermined ones, and the machine will be revealed as having been altered."

In short, Dr. Shamos's proposed approach would identify, from among the hundreds or thousands of machines anticipated for use in the 2019 Georgia municipal elections, only one machine for testing.[3]

5.   In my experience relying on a sample size of one is uncommon. The optimal size of a sample is dependent on, among other things, the anticipated extent of variation in outcomes in the population of interest. If outcomes are expected to be relatively more homogenous a smaller sample size will suffice, all other things equal. The more varied outcomes are expected to be within a population, the larger a sample size should be.

6.   In this context the population of interest is all machines to be used during the upcoming 2019 Georgia municipal and special elections.[4] For a sample of one machine to be useful, all machines would need to have identical malware. In other words, a sample of one could only be sufficient if the potential malware is

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[3] This is consistent with how S. Merritt Beaver, Chief Information Officers in the office of the Secretary State for the State of Georgia, described Georgia's parallel testing process. (*See* Decl. S. Merritt Beaver, ¶ 18, ECF No. 472-2.) According to Beaver, on election day, State Defendants conducted parallel testing by setting up a single voting machine in the Secretary of State's office. (*Id.*)

[4] According to Election Chiefs Joseph Blake Evans of the Fulton County Department of Registration and Elections, Fulton County plans on utilizing more than 500 DRE voting machines. Decl. Joseph Blake Evans, ¶ 4 ECF No. 473-1.

operating on 100 percent of machines, in the same manner, and is entirely detectable in all machines. In contrast, if different machines vary, and all machines are not identical with regard to the presence of malware, the outcomes are altered in different ways across machines, or malware is detectable in some machines but not others, then testing one machine makes it impossible to rule out the possibility that malware was used and vote outcomes altered as a result.

7.   As I understand their allegations, Plaintiffs allege malware may affect some, but not all, machines, that infected machines may be affected in different ways, and that uniform detection of malware may not occur even for infected machines.[5] If potential malware does not affect all machines in the same way a sample size of one machine is inadequate.

8.   As an example, consider a county planning to use 500 machines for the election, and one machine is selected for parallel testing.[6] If parallel testing of the one machine showed no malware and no altered outcomes, we can conclude with 95 percent confidence that no more than 475 machines might be infected. In other words, with a population of 500 machines and a sample size of one machine showing no malware, we *cannot* rule out that as many as 95 percent of the machines *may be* infected.

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[5] Dkt. No 498, Decl. J. Alex Halderman, ¶¶ 1-2.

[6] *See* supra Note 4.

I declare under the penalty of perjury that the foregoing is true and correct.

Dated this 18th day of July, 2019 in Washington, DC.

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Nathan D. Woods, PhD

APPENDIX A. CURRICULUM VITAE

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Nathan D. Woods, Ph.D.
Partner

Dr. Woods is an expert with more than 18 years of experience analyzing topics relating to class certification, labor and employment, sampling, extrapolation, and damage estimates. He applies his expertise in the construction and statistical analysis of large, complex data sets to assist clients in analyzing issues related to allegations of discrimination against gender, race/ethnic and age protected groups and all manner of wage and hour topics under federal and various state laws. He also provides guidance on sample design in a variety of contexts, including in healthcare and business disputes.

As an expert witness, Dr. Woods analyzes data and testifies on class action topics involving commonality, typicality, allegations of work "off-the-clock", non-payment of overtime, meal break violations, on issues related to manageability, representative sampling, extrapolation, damages, and on adverse impact studies. Dr. Woods has testified in bench and jury trials, in state and federal courts, and in administrative proceedings.

Outside of litigation, Dr. Woods regularly consults with Fortune 500 clients on a variety of labor and employment and other analytical topics. Included among these are assistance with the implementation and evaluation of large-scale diversity initiatives, monitoring of pay equity, performance, hiring and other employment decisions for possible adverse impact, auditing wage and hour compliance, and economic analyses of wages and benefits issues arising out of collective bargaining agreements. Dr. Woods often communicates complicated analysis results to affected stakeholder groups, including union membership, management, and legal counsel.

His peer-reviewed academic research focuses on using statistical analysis to answer questions related to race and ethnicity, representation, public opinion, and participation. He has published in *the American Political Science Review, the American Review of Politics, Bender's California Labor and Employment Bulletin, the Federal Employment Law Insider, the Journal of Health Care Compliance, the Journal of Politics, the Journal of Urban Affairs, Law360, the National Civic Review, PS, Political Research Quarterly, Social Sciences Quarterly, the Urban Affairs Review,* and as chapters in three edited volumes. He frequently writes and speaks on economic and statistical approaches to analysis of class certification, discrimination, and wage and hour questions. Dr. Woods has taught several courses to undergraduate and graduate students, including an advanced quantitative analysis graduate seminar at the University of Southern California.

Dr. Woods received his Ph.D. and M.A. degrees in Political Science from the School of Politics and Economics at the Claremont Graduate University and his B.A. in Political Science from the University of California, Davis.

E D U C A T I O N

Claremont Graduate University
Ph.D., Political Science, 2004
M.A., Political Science, 1999

University of California, Davis
B.A., Political Science, 1997

C U R R E N T   E M P L O Y M E N T

Edgeworth Economics, Washington, DC
March 2015-present, Partner

E M P L O Y M E N T   H I S T O R Y

Welch Consulting, Washington, DC
2007-2015 Vice President and Director
2003-2007 Economist (Santa Monica, CA)
2001-2003 Associate Economist (Santa Monica, CA)

University of Southern California, Los Angeles, CA
2005-2006 Adjunct Assistant Professor

Center for the Study of Los Angeles, Loyola Marymount University, Los Angeles, CA
2002-present Research Scholar and Statistical Consultant

McNair Scholars Program, Claremont Graduate University, Claremont, CA
2001-2002 Adjunct Assistant Professor

Chaffey College, Rancho Cucamonga, CA
1999-2001 Adjunct Assistant Professor

Tomás Rivera Policy Institute, Claremont, CA
1998-2000 Research Associate

H O N O R S   A N D   P R O F E S S I O N A L   A C T I V I T I E S

American Bar Association, Member
                Labor & Employment Section and Litigation Section: Employment & Labor Relations Committee
American Conference Institute, Continuing Legal Education, Speaker
Bridgeport, Continuing Legal Education, Speaker
Haynes Dissertation Fellowship, 2001-2002
Transitions Toward Diversity Fellowship, Chaffey College, 1999-2000
Claremont Graduate University SPE (1997-1998) and Richter Memorial Fellowships (1998-2000)

TESTIMONY AND EXPERT REPORTS (JULY 2015 TO PRESENT)

Expert Deposition Testimony on behalf of International Business Machines Corporation (IBM) in the matter of Gerald Iacono v. IBM., Case No. 2:17-cv-08083-FMO-PLA, United States District Court, Central District of California, April 2, 2019.

Expert Report on behalf of International Business Machines Corporation (IBM) in the matter of Gerald Iacono v. IBM., Case No. 2:17-cv-08083-FMO-PLA, United States District Court, Central District of California, March 5, 2019.

Expert Report on behalf of Coach Inc. (Tapestry Inc.) in the matter of Martha Vaughn et al. v. Coach Inc., Case No. 3:16-cv-04633-VC, United States District Court, Northern District of California, October 26, 2018.

Expert Declaration on behalf of the Government of the District of Columbia in the matter of Nickoya Hoyte et al. v. Government of the District of Columbia, Case No. 1:13-cv-00569 (CRC), United States District Court, District of Columbia, October 5, 2018.

Expert Report on behalf of the Government of the District of Columbia in the matter of Nickoya Hoyte et al. v. Government of the District of Columbia, Case No. 1:13-cv-00569 (CRC), United States District Court, District of Columbia, March 28, 2018.

Expert Trial Testimony on behalf of Omnicare Inc. in the matter of Eric Young v. Omnicare Inc., Case No. CIV. 5:16-cv-09788, United States District Court, Southern District of West Virginia, Beckley Division, February 28, 2018.

Amended Expert Report on behalf of Omnicare Inc. in the matter of Eric Young v. Omnicare Inc., Case No. CIV. 5:16-cv-09788, United States District Court, Southern District of West Virginia, Beckley Division, February 22, 2018.

Expert Report on behalf of Omnicare Inc. in the matter of Eric Young v. Omnicare Inc., Case No. CIV. 5:16-cv-09788, United States District Court, Southern District of West Virginia, Beckley Division, February 19, 2018.

Expert Affidavit on behalf of BJC Health System in the matter of Annette Speraneo v. BJC Health System., Case No. 1322-CC09701, Twenty-Second Judicial Circuit, City of St. Louis, Missouri, June 30, 2017.

Expert Report on behalf of Quanta Services Inc. in the matter of Michael DonMoyer v. Quanta Services, Inc., Case No. 1:15-cv-01992-RPM, United States District Court, District of Colorado, May 17, 2017.

Expert Report on behalf of Faneuil, Inc. in the matter of Tammy McNeil v. Fanueil, Inc., Civil Action No: 4:15-cv-81, United States District Court, Eastern District of Virginia, Newport News Division, April 13, 2017.

Expert Declaration on behalf of Schlumberger Technology Corporation in the matter of Chris Elliott v. Schlumberger Technology Corporation and Schlumberger Limited (Schlumberger N.V.), Case No. 3:13-cv-0079, United States District Court, District Court of North Dakota, January 19, 2017.

Expert Report on behalf of Bayhealth Medical Center Inc. in the matter of Dawn Mitchell v. Bayhealth Medical Center Inc., Case No. 1:15-cv-00187-LPS, United States District Court, District Court of Delaware, December 2, 2016.

T ESTIMONY AND E XPERT R EPORTS (2007 TO P RESENT C ONT .)

Expert Trial Testimony on behalf of Starbucks Corporation in the matter of Kileigh Carrington v. Starbucks Corporation, Case No. 37-2014-00018637-CU-OE-CTL, Superior Court of the State of California, County of San Diego, October 27, 2016.

Supplemental Expert Declaration on behalf of Starbucks Corporation in the matter of Kileigh Carrington v. Starbucks Corporation, Case No. 37-2014-00018637-CU-OE-CTL, Superior Court of the State of California, County of San Diego, October 19, 2016.

Expert Report on behalf of LVNV Funding, LLC. in the matter of Tara Dorrian v. LVNV Funding, LLC., Case No. 2014-02684-BLS2, Commonwealth of Massachusetts, Suffolk, SS. Superior Court Department, September 30, 2016.

Supplemental Expert Report on behalf of Schlumberger Technology Corporation in the matter of Chris Elliott v. Schlumberger Technology Corporation and Schlumberger Limited (Schlumberger N.V.), Case No. 3:13-cv-0079, United States District Court, District Court of North Dakota, September 16, 2016.

Expert Declaration on behalf of Starbucks Corporation in the matter of Kileigh Carrington v. Starbucks Corporation, Case No. 37-2014-00018637-CU-OE-CTL, Superior Court of the State of California, County of San Diego, July 21, 2016.

Expert Report on behalf of CEC Entertainment Inc. in the matter of Richard Sinohui v. CEC Entertainment, Inc., Case No. 5:14-cv-02516-JLS (KKx), United States District Court, Central District of California, Southern Division, April 1, 2016.

Expert Deposition Testimony on behalf of Schlumberger Technology Corporation in the matter of Chris Elliott v. Schlumberger Technology Corporation and Schlumberger Limited (Schlumberger N.V.), Case No. 3:13-cv-0079, United States District Court, District Court of North Dakota, March 29, 2016.

Expert Report on behalf of Schlumberger Technology Corporation in the matter of Chris Elliott v. Schlumberger Technology Corporation and Schlumberger Limited (Schlumberger N.V.), Case No. 3:13-cv-0079, United States District Court, District Court of North Dakota, January 29, 2016.

Expert Report on behalf of CEC Entertainment Inc. in the matter of Richard Sinohui v. CEC Entertainment, Inc., Case No. 5:14-cv-02516-JLS (KKx), United States District Court, Central District of California, Southern Division, November 20, 2015.

Expert Report on behalf of StoneMor Partners LP in the matter of Brandi Brodzenski v. StoneMor Partners LP, Case No.: 1:14-cv-2517, United States District Court, Northern District of Ohio, Eastern Division, August 24, 2015.

A C A D E M I C   P U B L I C A T I O N S

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"Majority Minority Districts, Co-ethnic Candidates and Mobilization Effects," (with G. Segura.), in *Voting Rights Act Reauthorization of 2006: Perspectives on Democracy, Participation, and Power*, 2007.

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"Homeowners Versus Renters: Southern California's New Fault Line," (with M. Marks and M. Barreto), *Urban Affairs Review*, pp. 42 and 315-341, 2007.

"Controversies in Exit Polling: Implementing a Racially Stratified Homogenous Precinct Approach," (with M. Barreto, F. Guerra, M. Marks and S. Nuño), *PS: Political Science & Politics*, pp. 39 and 477-483, 2006.

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"Metropolitan Latino Political Behavior: Voter Turnout and Candidate Preference in Los Angeles," (with M. Barreto and M. Villarreal), *Journal of Urban Affairs*, 27: 1 pp. 71-91, 2005.

"Latino Voting Behavior in an Anti-Latino Political Context," (with M. Barreto), in *Diversity in Democracy: Minority Representation in the United States*, 2005.

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"Race and Racial Attitudes a Decade After the 1992 Riots," (with M. Marks and M. Barreto), *Urban Affairs Review*, 40: 1 pp. 3-18, 2004.

"Presidential Approval and the Mixed Blessing of Divided Government," (with S. Nicholson and G. Segura), *The Journal of Politics*, 64: 3 pp. 701-20, 2002.

"Targets of Opportunity: Latinos and the Blanket Primary," (with G. Segura), in *Voting at the Political Fault Line: California's Experiment with the Blanket Primary*, 2002.

"Hispanics, Social Capital and Civic Engagement" (with G. Segura and H. Pachon), *National Civic Review*. 90:1, 2001.

"Turning Out the Latino Vote: Did Interest Group Efforts Matter?" (with A. Pantoja), *American Review of Politics,* 20: pp. 141-62, 1999.

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"How Estimates Can Miss the Mark on Age Discrimination," *Law360*, October 8, 2015 (with S. Bronars).

"Ten Questions to Ask Experts Working with Your Data" *Law360*, September 25, 2015 (with D. Foster and M. Kheyfets).

"Flawed Logic of DOL's Proposed White Collar Salary Test," *Law360*, August 25, 2015 (with D. Foster and S. Bronars).

"Approaches to Hourly Rates Under DOL White Collar Rules," *Law360*, August 14, 2015 (with D. Foster and S. Bronars).

"Statistical Sampling and Assessments of Commonality in Wage and Hour Class and Collective Actions," *Law360*, May 29, 2015.

"Statistical Testing of Commonality in Wage and Hour Class and Collective Actions," *Law360*, May 28, 2015.

"Getting Past Reliance on Overall Averages in Wage and Hour Class and Collective Actions," *Law360*, May 27, 2015.

"Narrowed Classes: Statistical Differences and Damages," *Law360*, August 8, 2011, (with J. Stixrud and D. Owens).

"Assessing the Validity of Statistical Samples in Medicare Audits," *Journal of Healthcare Compliance,* May-June 2011.

"The Role of Statistical Analysis in California Meal Break Class Actions After Brinker," *Bender's CA Labor and Employment Bulletin*, December 2010 (with G. E. Anderson).

PRESENTATIONS (2005 TO PRESENT)

"Predictive and Flexible Scheduling: What, Where, When, and Why"
   Kronos Retail & Hospitality Summit, Hilton Head, SC,
   May 2018.

"Predictive and Flexible Scheduling: What, Where, When, and Why"
   Kronos Retail Touchpoints Webinar,
   May 2018.

"DOL Overtime Exemption Rule is Final! Understanding Immediate Action Items and Key Compliance Dates"
   Business & Legal Resources (BLR),
   June, July, October 2016.

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"Preparing for the New DOL White Collar Exemption Rules"
  Kronos Retail & Hospitality Summit, Pebble Beach, CA,
  May 2016.

"The DOL's White Collar Rule Changes: Implications and Today's Must Dos"
  Edgeworth Economics Webinar Series,
  October 2015.

"Your Applicant Data: Strategic Ways to Proactively Analyze and Manage Them"
  Bridgeport Continuing Legal Education, Litigating Discrimination and Harassment Claims, Los Angeles, CA,
  August 2015.

"Analysis of Merits and Damages in Pregnancy Discrimination Claims"
  American Conference Institute's CLE Employment Discrimination Litigation conference, Chicago, IL,
  July 2015.

"Use of Data to Analyze Allegations of Unpaid Pre/Post Shift Work"
  American Conference Institute's CLE Wage & Hours Claims and Class Actions conference, Miami, FL,
  January 2015.

"Analysis of Representative Evidence, Commonality and Typicality"
  American Conference Institute's CLE Wage & Hours Claims and Class Actions conference, New York, NY,
  May 2014.

"Your Applicant Data: Out of the Darkness and Into the Light."
  Paul Hastings,
  April 2014.

"Strategies for Compiling and Presenting Data in Wage & Hour Class/Collective Actions."
  Wage and Hour Defense Institute Annual Meeting,
  March 2014.

"Using Expert Data Analysis in Wage and Hour Class Actions."
  Bridgeport Continuing Legal Education,
  March 2014.

"Expert Data Analysis to Address Class Certification Issues."
  American Conference Institute's CLE Wage & Hours Claims and Class Actions conference, Miami, FL,
  January 2014.

"Are You Calculating Work Time Accurately?"
  Bridgeport CLE Fair Labor Standards Act conference, New York, NY,
  April 2013.

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"Use of Experts in Wage and Hour Class Actions."
> *Bridgeport CLE conference on Wage and Hour Class Actions*, Chicago, IL,
> October 2012.

"Class Action Data Analytical Issues after Wal-Mart v. Dukes"
> *Bridgeport CLE Conference on Consumer Class Actions*, San Diego, CA,
> January 2012.

"Time-Clocks, Employee Swipe Behavior and Implications for Wage and Hour Litigation"
> *Center for Statistics and the Social Sciences*, University of Washington, Seattle, WA,
> April 4, 2007.

"Majority Minority Districts, Co-ethnic Candidates and Mobilization Effects"
> *Protecting Democracy: Using Research to Inform the Voting Rights Reauthorization Debate*, University of
> California, Washington Center,
> February 9, 2006.

"An Assessment of Racially Polarized Voting For and Against Latino Candidates"
> *Protecting Democracy: Using Research to Inform the Voting Rights Reauthorization Debate*, University of
> California, Washington Center,
> February 9, 2006.

"Controversies in Exit Polling: Implementing a Racially Stratified Homogenous Precinct Approach"
> *Annual Meeting of the American Evaluation Association, Joint AEA/CEA Meeting,* Toronto, ON,
> October 27-30, 2005.

"The Use of Acculturation Measures"
> *Annual Meeting of the American Evaluation Association, Joint AEA/CEA Meeting* Toronto, ON,
> October 27-30, 2005.

"Correlates of Precinct Quality in Los Angeles"
> *Annual Meeting of the Western Political Science Association,* Oakland, CA,
> March 17-20, 2005.

"Latino Politics and the 2004 Presidential Elections" Panel Moderator/Discussant
> *Meeting on Latino Politics in California 2004-2005* Los Angeles, CA,
> January 26, 2005.

APPENDIX B. MATERIALS RELIED UPON

Court Filings

State Defendants' Combined Response in Opposition to Plaintiffs' Motions for Preliminary Injunction, July 10, 2019

Declaration of Michael Shamos, Ph.D., J.D., July 10, 2019

Declaration of Joseph Blake Evans, July 10, 2019

Declaration of S. Merritt Beaver, July 9, 2019

Declaration of J. Alex Halderman, July 18, 2019